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Microstructural and Mechanical Evaluation of Laser-Assisted Cold Sprayed Bio-ceramic Coatings: Potential Use for Biomedical Applications

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Abstract

Bio-composite coatings of 20 wt.%, HAP and 80 wt.%, HAP were synthesized on Ti-6Al-4V substrates using LACS technique. The coatings were produced with a laser power of 2.5 kW, powder-laser spot trailing by 5 s. The coatings were analyzed for the microstructures, microhardness, composition, and bio-corrosion using SEM-EDS, XRD, hardness tester, and Metrohm PGSTAT101 machine. SEM images indicated least pores and crack-free coating with dark-spots of Ti-HAP for the 20 wt.%, HAP as opposed to the 80 wt.%, HAP coating which was solid, porous and finely cracked and had semi-melted Ti-HAP particles. The EDS mappings showed high content of HAP for the 80 wt.%, HAP coating. The diffraction patterns were similar, even though the Ti-HAP peak was broader in the 80 wt.%, HAP coating and the HAP intensities were lower for this coating except for the (004) peak. The hardness values taken at the interface inferred that the 80 wt.%, HAP coating was least bonded. It was possible to conclude that when this phase material increased the hardness dropped considerably. The bio-corrosion tests indicated that the presence of HAP in coating leads to a kinetically active coating as opposed to pure titanium coating.